

29. ENDOGENOUS RHYTHM IN OPENING AND CLOSING OF FLOWERS IN *PORTULACA* SPECIES

(With a text-figure)

Portulaca is the commonest genus of the family Portulacaceae with varying shades of yellow or red coloured flowers which in nature open and close at certain fixed times of the day. It has been stated that the flowers remain closed in bad weather (Willis 1966). The opening and closing of flowers of *Cestrum nocturnum* have been found to occur in a cyclic manner both in constant light and constant darkness at constant temperature (Overland 1960).

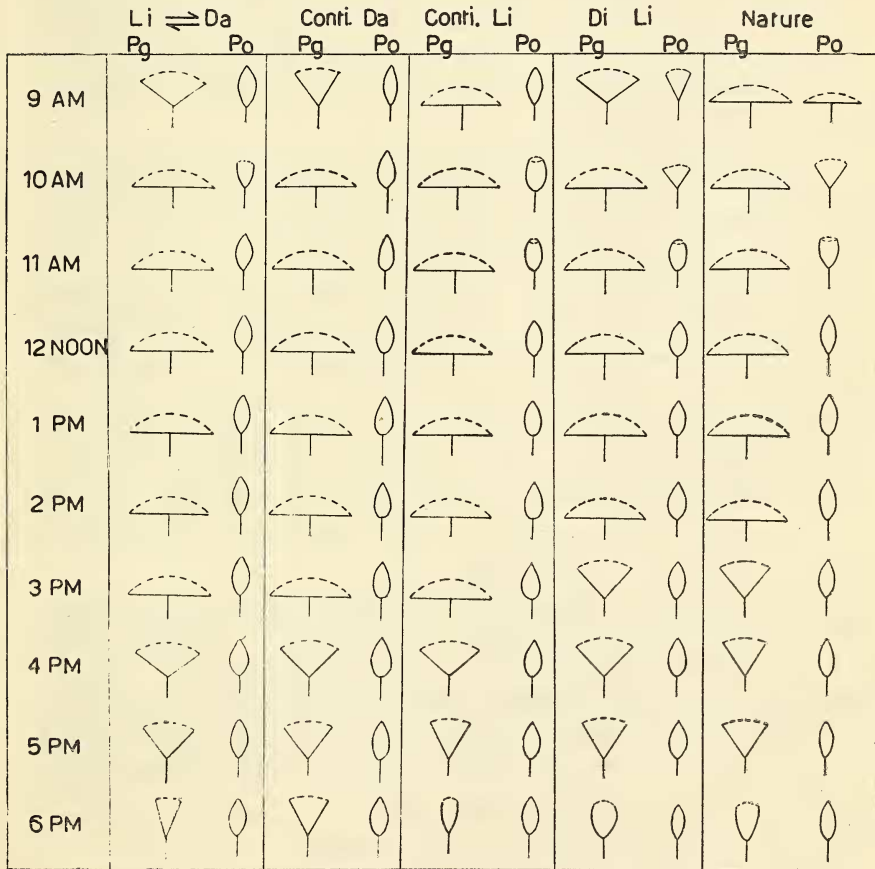


Fig. 1. Opening and closing of flowers in *P. grandiflora* (Pg) and *P. oleracea* (Po) under alternate light and dark (Li Da), continuous dark (Conti. Da), continuous light (Conti. Li), diffuse light (Di Li) conditions, and in nature from 9 a.m. to 6 p.m.

The present investigation on the behaviour of flowers in *Portulaca* under controlled and environmental conditions were undertaken in order to determine the possibility of the association of flower opening and closing with endogenous rhythms. It has been stated that the 'endogenous rhythm' refers to a biological process which alters periodically in a pendulum-like manner although external conditions remain constant (Bünning 1956).

The materials used in the present experiments performed in the month of August 1970 were flowers and bud bearing twigs of *P. grandiflora* and *P. oleracea*. These twigs were kept in beakers containing tap water and were exposed to continuous total darkness or continuous light. A set was put in dark before sun rise, and another after opening of the flowers at 9 a.m. A set of plants were alternately exposed to artificial light and total darkness for one hour each. A set each was exposed to red light for 5 minutes and another to far-red, and still a third one first to far-red followed by red light. A set of each was kept in total darkness and another in artificial light of 40 f.c., intensity.

The opening and closing of floral buds were observed from 9 in the morning till 6 in the evening at each hour. The sequence of opening and closing of the flowers during different hours of the day under varying conditions are shown in Fig. 1.

It is apparent from figure 1 that the opening of the floral buds do not depend on light alone. In case of *P. grandiflora* the opening and closing of flowers appeared nearly independent of light/dark conditions, although complete opening of flowers took place earliest by 9 or 9.15 in the morning in nature and also in twigs transferred to continuous light condition. They remained open longest in the continuous illumination, although flowers started closing after 3 in the afternoon under all the conditions. On a cloudy day the opening of buds was delayed to a large extent.

The opening and closing of flowers in case of *P. oleracea* was more distinct and sharp as compared to *P. grandiflora*. The floral buds in nature opened fully about 9 and closed nearly completely by 11 in the morning. In cut twigs the rhythm appeared to be discontinuous, as the buds did not open at all in those which were kept in total darkness. They very slightly opened at 10 a.m., under alternate light and dark and also in continuous light conditions. The behaviour under diffuse light was nearly similar to that in nature.

The opening and closing of floral buds in the above mentioned plants, believed to be a direct result of light and darkness, has been found to exist as an endogenous rhythm independent of outer environ-

ment. It was found to occur in an entirely constant condition of light/dark and temperature. However, in nature, in a very clouded and drizzling weather, the old flowers will open but attain an intermediate position which is neither completely closed nor open. This would suggest that opening and closing of flowers is initiated and controlled by an endogenous rhythm, but the completion of the act is supported by prevailing environmental conditions, mainly light.

Most of the flower buds exposed to far-red or far-red/red did not exhibit any effect on plants as a whole. Those exposed to red and kept in dark had an effect on the opening of flowers. This suggests that the phytochrome system is not responsible for opening and closing of flowers in *P. grandiflora*. Extremely low concentrations (0.01-0.05 ppm) of kinetin and 2ip were supplied to the twigs bearing flowers from their cut ends. There has been no appreciable effect on the opening and closing of the flowers. In diffuse light 0.05 ppm of 2ip solution hastened flower opening as compared to kinetin.

The movements in some African plants were also studied under conditions of natural light to determine their opening and closing by Cesaire *et al.*, (1966). Besides other plants *P. grandiflora* and *P. oleracea* were reported to be opened 90 minutes to 3 hours after sunrise and closed their flowers at noon or soon afterwards. They have reported that each species had a characteristic rhythm and some flowers even reacted normally to light when separated from the plant. Temperature, humidity and barometric pressure are reported to exert an influence.

BOTANY DEPARTMENT,
UNIVERSITY OF JODHPUR,
JODHPUR, (RAJ.),
March 16, 1971.

D. N. SEN
K. D. SHARMA
M. C. BHANDARI

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